

MA 341: Topics in Geometry¹

MWF 11:00-11:50 AM CB 307

Fall 2021

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Class webpage: Canvas — <https://uk.instructure.com>

Course Description: Selected topics in geometry including Euclidean and some non-Euclidean geometries.

Prerequisites: The prerequisite is MA 261

Textbook: *Euclidean Geometry: A Guided Inquiry Approach* by David Clark.

Suggested software: *GeoGebra* is a free software available for download at <https://www.geogebra.org>.

Course Structure and Student Learning Outcomes: Let's begin with two axioms that come from Federico Ardila, a professor at San Francisco State University.

Axiom #1: *Mathematical talent is uniformly distributed, irrespective of geographic, demographic, and economic boundaries.* (Growing and harvesting it is the right/smart thing to do.)

Axiom #2: *Everyone can have meaningful and rewarding mathematical experiences.* (Mathematics needs users, fans, and ambassadors.)

This is a course designed to grow and harvest the talents that each of you have (and yes, each of you have mathematical talents and value, though these typically take different forms from person to person). In this course we will work collaboratively on meaningful and rewarding mathematical experiences through these experiences, we will deepen our abilities to serve as responsible citizens in society, to effectively use mathematics, and to

¹I reserve the right to change or amend this syllabus at any time for any reason.

enjoy mathematics and share that joy with the people around us. The central focus of our investigations will be the study of geometry from an axiomatic viewpoint.

The presentation uses a guided inquiry, active learning pedagogy. You will benefit from the axiomatic development because you yourselves solve the problems and prove the theorems with me, the instructor, serving as a guide and mentor. You are thereby empowered with the knowledge that you can solve problems on your own without reference to authority.

Mathematical Content Goals: Students in MA 341 will deepen their understanding of:

- geometry as an axiomatic system;
- Euclidean geometry theorems;
- methods of proof;
- methods of problem solving.

Course Policy on Discourse Students are not allowed to make disparaging comments, at any time or for any reason, about themselves, their mathematical ability, their peers, or the abilities of their peers. Here are example statements that are prohibited, along with acceptable replacement phrases.

- I can't do this. → I am still learning how to do this.
- That was stupid. → That was a productive mistake.
- This is impossible. → There is something interesting and subtle in this problem.
- I'm an idiot. → This is going to take careful thought.
- I'll never understand this. → This might take me a long time and a lot of work to figure out.
- This is terrible. → I think I've done something incorrectly, let me check it again.

The banned phrases represent having a fixed view of your own intelligence, which does not reflect the reality that you are all capable of dynamic, continued learning. The suggested replacement phrases support and represent having a growth mindset regarding your abilities and your capacity for improvement.

Grades: There will be four elements to assessment and grading in this course: Participation, Homework, Exams, and a final Portfolio.

Participation:

- You must be present and engaged in class each day.
- You will be assigned to groups and you are expected to present at the board one n^{th} of the proofs or problems where n is the number of people in your group.
- Once you have been assigned a proof or a problem it is yours until it is solved or we move on into the next part of the course.

Homework:



- Assignments are online. Homework will be due weekly. I will indicate which problems are to be turned in each week.
- No late work will be accepted.
- You should work with other students and share your ideas as part of our course community. However, you should not let your collaboration devolve into letting someone else do all the “hard parts” and then copying their answers.
- Four Rules for Assignments:
 - Don’t talk to anyone about the problems until you have made a genuine effort to solve them yourself.
 - You must write up the solutions on your own.
 - For each problem, write the names of any other people (students, tutors, etc) with whom you shared ideas.
 - You may not search the internet for solutions to problems. We will use our creativity, course texts, and peer collaboration as our tools.
 - I am always available for you to ask questions and get help on the homework or boardwork.

Exams

- Exams will take place on the dates listed in our class calendar.
- The final exam will take place on XXX, XX Dec 2021, at XX:XX AM.

Portfolio Over the course of the semester you will hand in and put on the board a number of proofs. Choose your favorite four to six proofs and write a narrative to accompany each one. Put them together, in an order that makes sense, and write an introduction to this collection and a conclusion. Hand this in with a cover letter, addressed to me, indicating your intended audience. Naturally all this should be typed.

The Proofs: Ideally you should choose proofs that you are proud of and that illustrate different concepts and/or methods of proof. Since you will have plenty of opportunity for feedback, the proofs must be valid.

Your Audience for the Narratives, Introduction, and Conclusion: You need to choose an audience that is appropriate for you. I will be reading and grading these, but I would like the portfolio that you create to be something that could be useful for you in the future. Therefore, your audience should be someone you might want to impress in the future. For example, if you are interested in becoming a high school teacher, your audience might be county math supervisors.

If you are interested in graduate school in mathematics, it could be mathematicians at a research university. If you are interested in getting a job in industry, your audience should be people who do the hiring in the type of industry in which you are interested in working. Whichever audience you choose, you need to indicate this choice in your cover letter.

The Narratives: You should indicate, in language appropriate for your audience, why each proof has been chosen. The narratives should answer questions like:

- What is the significance of the result proven?
- What technique(s) of proof are illustrated?
- How did you arrive at the proof?
- Why do you like it?
- Is it beautiful? Crisp? Messy? Easy to follow? Tricky? ...etc.

The Introduction and Conclusion: Your introduction and conclusion should be relatively short, indicate the method of organization, and list the proofs included.

Use of the Internet There are many resources available to you to help you understand the material in this course. The primary tools you should be using are: your textbook, your instructor, your fellow students, your brain and skills acquired in prerequisite courses. Only when these have been tapped to their fullest should you consider turning to the internet. Therefore, I ask that you not consult internet sources on topics about which you have yet to ask a question either in class or during office hours.

Most importantly, although you may be able to find solutions to some of our homework problems online; you are not permitted to do so before submitting your homework to me. If you do, then this constitutes an instance of academic misconduct and will be treated as such in accordance with the university policy. Looking up solutions to problems online is NOT the skill which you should be developing by doing your homework. If you are unable to solve a problem on your own, please make time to see me for help and/or discuss it with your classmates. A partial solution, or an account of the things that you tried unsuccessfully is better than a solution which is not your own.

Course Grades Your course grade will be determined by your participation, assignments, portfolio, and exams.

- Boardwork: 30%
- Homework: 20%
- Exams: 40%
- Portfolio 10%

Mid-term Grades: Mid-term grades will be posted on myUK by the deadline established in the Academic Calendar

(<http://www.uky.edu/Registrar/AcademicCalendar.htm>).

Course Policies:

- *Attendance:* Attend lectures and recitations regularly. Be on time and remain until dismissed. Do not leave in the middle of class. Instructors have the right to take off attendance points for coming late or leaving early. If you cannot come to lecture or recitation and would like to request an excused absence, inform the instructor as early as possible and provide documentation.



- *Unexcused Absences:* You are allowed 2 unexcused absences. Beyond that, you will lose 2% of your overall course grade for each unexcused absence.
- *Excused Absences:* Students need to notify the professor of absences prior to class when possible. Senate Rule 5.2.4.2 defines the following as acceptable reasons for excused absences: (a) serious illness, (b) illness or death of family member, (c) University-related trips, (d) major religious holidays, and (e) other circumstances found to fit "reasonable cause for nonattendance" by the professor.
Students anticipating an absence for a major religious holiday are responsible for notifying the instructor in writing of anticipated absences due to their observance of such holidays no later than the last day in the semester to add a class.
- Students are expected to withdraw from the class if more than 20% of the classes scheduled for the semester are missed (excused) per University policy. Per Senate Rule 5.2.4.2, students missing any graded work due to an excused absence are responsible: for informing the Instructor of Record about their excused absence within one week following the period of the excused absence (except where prior notification is required); and for making up the missed work. The professor must give the student an opportunity to make up the work and/or the exams missed due to an excused absence, and shall do so, if feasible, during the semester in which the absence occurred.
- *Verification of Absences:* Students will be asked to verify their absences in order for them to be considered excused. Senate Rule 5.2.4.2 states that faculty have the right to request "appropriate verification" when students claim an excused absence because of illness or death in the family. Appropriate notification of absences due to university-related trips is required prior to the absence when feasible and in no case more than one week after the absence.
- Classes do meet as usual on Monday and Tuesday of Thanksgiving week. Attendance rules apply as usual.
- *Missed work* In order to be fair to all students, dates for exams and homework assignments are firm. It is very important to take each exam on schedule. Missed work may be made up only due to illness with medical documentation or for other unusual (documented) circumstances. If you have a university excused absence or a university-scheduled class conflict with uniform examinations please contact your lecturer as soon as possible, but at least 10 days before the exam, so that an alternate exam can be arranged for you.
- *Academic Dishonesty:* Per university policy, students shall not plagiarize, cheat, or falsify or misuse academic records. Students are expected to adhere to University policy on cheating and plagiarism in all courses. The minimum penalty for a first offense is a zero on the assignment on which the offense occurred. If the offense is considered severe or the student has other academic offenses on their record, more serious penalties, up to suspension from the university may be imposed.

Plagiarism and cheating are serious breaches of academic conduct. Each student is advised to become familiar with the various forms of academic dishonesty as explained in the Code of Student Rights and Responsibilities. Complete information can be found at the website Ombud. A plea of ignorance is not acceptable as a defense against the charge of academic dishonesty. It is important that you review this information as all ideas borrowed from others need to be properly credited. Senate Rules 6.3.1 (see Senate Rules for the current set of Senate Rules) states that all academic work, written or otherwise, submitted by students to their instructors or other academic supervisors, is expected to be the result of their own thought, research, or self-expression. In cases where students feel unsure about a question of plagiarism involving their work, they are obliged to consult their instructors on the matter before submission. When students submit work purporting to be their own, but which in any way borrows ideas, organization, wording, or content from another source without appropriate acknowledgment of the fact, the students are guilty of plagiarism.

Plagiarism includes reproducing someone else's work (including, but not limited to a published article, a book, a website, computer code, or a paper from a friend) without clear attribution. Plagiarism also includes the practice of employing or allowing another person to alter or revise the work, which a student submits as his/her own, whoever that other person may be. Students may discuss assignments among themselves or with an instructor or tutor, but when the actual work is done, it must be done by the student, and the student alone. When a student's assignment involves research in outside sources or information, the student must carefully acknowledge exactly what, where and how he/she has employed them. If the words of someone else are used, the student must put quotation marks around the passage in question and add an appropriate indication of its origin. Making simple changes while leaving the organization, content, and phraseology intact is plagiaristic. However, nothing in these Rules shall apply to those ideas, which are so generally and freely circulated as to be a part of the public domain.

Students are encouraged to work together to understand a problem and to develop a solution. However, the solution you submit for credit must be your own work. In particular, you should submit your answers for web homework. Copying on exams and usage of books, notes, or communication devices during examinations is not allowed. Cheating or plagiarism is a serious offense, and it will not be tolerated. Students are responsible for knowing the University policy on academic dishonesty. The following are a few examples of academic dishonesty

1. using someone else's clicker in class or asking someone to falsely use one's clicker in class;
2. sharing answers on an exam by texting or other messaging apps;
3. having another student complete an assignment for you or give you an-

swers to specific questions;

4. using unauthorized materials or hardware on an exam;
5. looking at another student's answers during an exam;
6. having someone else take your exam for you;
7. lying about having taken an exam or completed an assignment.

- Be on time to class and remain until dismissed. Do not leave in the middle of class.
- *Accommodations due to disability.* If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (DRC). The DRC coordinates campus disability services available to students with disabilities. It is located on the corner of Rose Street and Huguelet Drive in the Multi-disciplinary Science Building, Suite 407. You can reach them via phone at (859) 257-2754 and via email at drc@uky.edu. Their web address is <http://www.uky.edu/StudentAffairs/DisabilityResourceCenter/>.

- *Class Recording Notification* The University of Kentucky Student Code of Conduct defines Invasion of Privacy as using electronic or other devices to make a photographic, audio, or video record of any person without their prior knowledge or consent when such a recording is likely to cause injury or distress.

Meetings of this course may be recorded. All video and audio recordings of lecturers and class meetings, provided by the instructors, are for educational use by students in this class only. They are available only through the Canvas shell for this course and are not to be copied, shared, or redistributed.

As addressed in the Student Code of Conduct, students are expected to follow appropriate university policies and maintain the security of linkblue accounts used to access recorded class materials. Recordings may not be reproduced, shared with those not enrolled in the class, or uploaded to other online environments.

If the instructor or a University of Kentucky office plans any other uses for the recordings, beyond this class, students identifiable in the recordings will be notified to request consent prior to such use. In anticipation of such cases, students may be asked to complete an "authorization of use" form by a faculty member.

Video and audio recordings by students are not permitted during the class unless the student has received prior permission from the instructor. Any sharing, distribution, and or uploading of these recordings outside of the parameters of the class is prohibited. Students with specific recording accommodations approved by the Disability Resource Center should present their official documentation to the instructor. All content for this course, including handouts, assignments, and lectures are the intellectual property of the instructors and cannot be reproduced or sold without prior permission from the instructors. A student may use the material for reasonable educational and professional purposes extending beyond this class, such as studying

for a comprehensive or qualifying examination in a degree program, preparing for a professional or certification examination, or to assist in fulfilling responsibilities at a job or internship.

- *Non-Discrimination Statement and Title IX Information* UK is committed to providing a safe learning, living, and working environment for all members of the University community. The University maintains a comprehensive program which protects all members from discrimination, harassment, and sexual misconduct. For complete information about UK's prohibition on discrimination and harassment on aspects such as race, color, ethnic origin, national origin, creed, religion, political belief, sex, and sexual orientation, please see the electronic version of UK's Administrative Regulation 6:1 ("Policy on Discrimination and Harassment"). In accordance with Title IX of the Education Amendments of 1972, the University prohibits discrimination and harassment on the basis of sex in academics, employment, and all of its programs and activities. Sexual misconduct is a form of sexual harassment in which one act is severe enough to create a hostile environment based on sex and is prohibited between members of the University community and shall not be tolerated. For more details, please see the electronic version of Administrative Regulations 6:2 ("Policy and Procedures for Addressing and Resolving Allegations of Sexual Assault, Stalking, Dating Violence, Domestic Violence, and Sexual Exploitation"). Complaints regarding violations of University policies on discrimination, harassment, and sexual misconduct are handled by the Office of Institutional Equity and Equal Opportunity (IEEO), which is located in 13 Main Building and can be reached by phone at (859) 257-8927. You can also visit the IEEO's website.

Faculty members are obligated to forward any report made by a student related to IEEO matters to the Office of Institutional Equity and Equal Opportunity. Students can confidentially report alleged incidences through the Violence Intervention and Prevention Center, Counseling Center, or University Health Services.

- *Diversity, Equity, and Inclusion* The University of Kentucky is committed to our core values of diversity and inclusion, mutual respect and human dignity, and a sense of community (Governing Regulations XIV). We acknowledge and respect the seen and unseen diverse identities and experiences of all members of the university community. These identities include but are not limited to those based on race, ethnicity, gender identity and expressions, ideas and perspectives, religious and cultural beliefs, sexual orientation, national origin, age, ability, and socioeconomic status. We are committed to equity and justice and providing a learning and engaging community in which every member is engaged, heard, and valued.

We strive to rectify and change behavior that is inconsistent with our principles and commitment to creating a safe, equitable, and anti-racist environment. If students encounter such behavior in a course, they are encouraged to speak with the instructor of record or the college's diversity officer, who is charged with addressing con-

cerns about diversity, equity, and inclusiveness. Students may also contact a faculty member within the department, program director, the director of undergraduate or graduate studies, the department chair, or the dean. To submit an official report of bias, hatred, racism, or identity-based violence, visit the Bias Incident Support Services website: <https://www.uky.edu/biss/>.

Inclement Weather Policy: The University of Kentucky Severe Weather Policy can be found at http://www.uky.edu/PR/News/severe_weather.htm. The UK Infoline at (859) 257-5684, UK TV Cable Channel 16 and 19, or the UK Web site at www.uky.edu are the best places to find the most up-to-date situation.

If you feel that travel during inclement weather would be hazardous, then try to inform your instructor as soon as safely possible. You will be given the opportunity to make up any work missed or due on that day. As always, each student is responsible for any work missed and will be expected to get the notes from another student or from the web.